

REMARKS

Claim 1, 2, 4-10, 12-14, 16-20, 22, 24 and 27 are rejected for obviousness-type double patenting; Claims 1, 2, 4, 7-10, 12, 22 and 27 are rejected under 35 USC §102 ; and Claims 5, 6, 13, 14 and 16-20 are rejected under 35 USC §103. The Applicants respectfully traverse these rejections and request reconsideration of the application in view of the above amendments and the following remarks.

Claim 12 has been amended and Claim 22 has been canceled. These changes do not constitute new matter since this clarification of the claims is supported by the original disclosure.

Claims 1, 2, 7-10, 12-14, 22, 24 and 27 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-10 of co-pending Application No. 09/206,208. The Office Action suggests that both sets of claims disclose a catalytic cracking of an olefin to produce propylene by using a de-aluminated catalyst.

Claims 1, 2, 4-10, 12-14, 16, 17, 20, 22, 24 and 27 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-16 of co-pending Application No. 09/206,207. The Office Action suggests that both sets of claims disclose a catalytic cracking of an olefin to produce propylene by using a de-aluminated catalyst.

Claims 1, 2, 4-10, 12-14, 22, 24 and 27 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-16 of co-pending Application 09/206, 218. The Office Action suggests that both sets of claims disclose a catalytic cracking of an olefin to produce propylene by using a dealuminated catalyst.

The Applicants will submit a terminal disclaimer upon an indication from the Examiner that all other rejections have been withdrawn.

Claims 1, 2, 4, 7-10, 12, 22 and 27 were rejected under 35 USC §102(b) as being anticipated by EP 0109060. Specifically, the Office Action suggests that EP 0109060 discloses a process of cracking a hydrocarbon feed into propylene and ethylene by contacting it with an alumino-silicate having a crystalline zeolitic structure and a $\text{SiO}_2/\text{Al}_2\text{O}_3$ molar ratio equal to or greater than 350 (Si/Al atomic ratios of equal to or greater than 175) at a temperature of from 400-600°C at atmospheric pressure and a space velocity of from 5-200 h^{-1} . (500)

EP 0109060 does not specifically disclose the specific silicon/aluminum atomic ratio of from 180 to 1000 or the specific inlet temperature of from 500 to 600°C or LHSV ranges of from 10 to 30 h^{-1} as required by the invention, as claimed in Claims 1, 2, 4, 7-10 and 12. Broader ranges than those claimed are, in fact, disclosed in EP 0109060. Claim 22 has been canceled. With regard to Claim 27, EP 0109060 does not disclose contacting a first hydrocarbon stream comprising light cracked naptha and a second hydrocarbon stream comprising C₄ olefins with a crystalline silicate catalyst. EP 0109060 does not disclose treating two such streams of different compositions. (1) (2)

It is well-known case law that to establish anticipation a reference must contain within itself a sufficient description to enable a person having ordinary skill in the art to make the invention without any unreasonable amount of experimentation. Any degree of difference, however slight, invalidates claims of anticipation. Accordingly, it is submitted that Claims 1, 2, 4, 7-10, 12 and 27 are novel over EP 0109060.

Claims 5, 6, 13 and 14 were rejected under 35 USC §103(a) as being obvious over EP 0109060. Specifically, the Office Action suggests that EP 0109060 discloses a process for cracking a hydrocarbon feed as noted above.

The Examiner has not rejected Claim 1 as being obvious over EP 0109060. To the extent that Claims 5, 6, 13 and 14 are dependent on Claim 1, which has not been

rejected as obvious over EP 0109060, it is submitted that those claims are correspondingly allowable.

If the Examiner considers that Claim 1 is obvious over EP 0109060, it is submitted that EP 0109060 discloses a silica/alumina molar ratio equal to or greater than 350, which corresponds to a silicon/aluminum atomic ration of equal to or greater than 175. There is no disclosure or even suggestion in EP 0109060 of an upper limit for that silica/alumina molar ratio. In fact, as is immediately apparent from the Examples, in particular Examples 3, 4, 8, 14-25 and 32-35 as shown in the Tables, EP 0109060 only exemplifies silica/alumina molar ratios of infinity. The range defined in amended Claim 1 is accordingly defined narrowly compared to the actual open-ended range disclosed in EP 0109060. (1)

It has been found that by selecting a silicon/aluminium atomic ratio of from 180 to 1000, in combination with the specific inlet temperature and LHSV ranges recited in Claims 1, the high propylene yield can be obtained over a significant period of time. Silicon/aluminium atomic ratios outside the range tend to reduce the durability of the catalyst over time as a result of, for example, the formation of coke on a catalyst, as shown in Example 5.

The selected range for the silicon/aluminium atomic ratio of from 180 to 1000 could not have been derived by a person of ordinary skill in the art from EP 0109060 without undue experimentation. In fact, all of the Examples of EP 0109060 direct the person of ordinary skill in the art to using silicon/aluminium atomic ratios of infinity, and thus away from the invention. It is accordingly submitted that nothing in that cited reference discloses, teaches or suggests the particular silicon/aluminium atomic ratio range required by Claim 1, more particularly in combination with the particular inlet temperature range and the particular LHSV range. The mere fact that the prior art could be modified does not make the modification obvious unless the prior art suggested the desirability of the modification. There is no suggestion in EP 0109060 of the desirability or incentive to use a silicon/aluminium atomic ratio of from 180 to 1000 instead of a (3)

silicon/aluminium ratio of up to infinity, especially in combination with an inlet temperature of from 500 to 600°C and an LHSV of from 10 to 30 h⁻¹.

With regard to the inlet temperature, the inlet temperature range claimed of from 500 to 600°C is narrower than that disclosed in the cited reference. While the examples of the cited reference employ a temperature falling within the range claimed in amended Claim 1, there is no disclosure or suggestion in the cited reference of the specific combination of silicon/aluminium atomic ratio, space velocity and temperature now required by Claim 1, as amended.

With regard to the space velocity, the cited reference discloses a weight space velocity of 5 to 200 dk/h which is a much broader range than the LHSV range of 10 to 30 h⁻¹ required by the amended Claim 1. The present inventors have found that by using a space velocity within the range claimed this ensures good propylene yield. None of the Examples of the cited reference employing silicalite-1 as the catalyst employs a space velocity falling within the claimed range.

Even if a prima facie case of obviousness were established, the unexpected results disclosed in the present application would satisfy the requirements of patentability. The Examiner's attention is respectfully directed to pages 31-32, Example 5, page 60, and Table 11, wherein silicon/aluminium atomic ratios outside the claimed range were not as effective in increasing propylene yield and formed coke on the catalyst which would result in poor stability (page 31, lines 25-29). The same results are shown on pages 41-42, Example 16, and Figure 9, wherein catalysts having silicon/aluminium atomic ratios outside the claimed range were not as effective in increasing propylene yield. In addition, it is noted that where the catalyst has been pre-treated by steaming and de-aluminating as specified in Claim 24, the silicon/aluminium atomic ratio need only be greater than 180 rather than at least 300 for an untreated catalyst (page 41, line 32, through page 42, line 5). Also, having an olefin partial pressure from 0.1 to 2 bars as specified in Claim 13 produces advantageous results. In Example 6, page 32, line 12, through page 33, line 14,

and Table 12, page 61, there is a higher propylene yield and lower paraffin and heaving compound (C_6+) for the run at 1.2 bars over the run at 3 bars.

There is no disclosure or suggestion that such unexpected results could be realized by a process for cracking an olefin-rich hydrocarbon feedstock with a crystalline silicate catalyst having a silicon/aluminium atomic ratio of from 180 to 1000, an inlet temperature of 500 to 600°C and an LHSV of from 10 to 30 h⁻¹. Even if the ranges may fall with the general disclosures of the cited references, the claimed invention distinguishes the specified ranges by producing unexpected benefits from the combination of these process conditions, e.g. silicon/aluminium atomic ratio, inlet temperature and space velocity.

Claims 16-20 were rejected under 35 USC §103(a) as being obvious over EP 0109060 in view of Cosyns. Specifically, the Office Action suggests that EP 0109060 discloses a process for cracking a hydrocarbon feed as noted above, and Cosyns discloses a hydrogenation process for producing a diolefin containing hydrocarbon stream by steam cracking and hydrogenating the diolefin with a catalyst to convert it into a mono-olefin.

The Examiner has not rejected Claim 1 as being obvious over EP 0109060 in view of Cosyns. To the extent that Claims 16-19 are dependent on Claim 1, which has not been rejected as obvious over EP 0109060 in view of Cosyns, it is submitted that those claims are allowable.

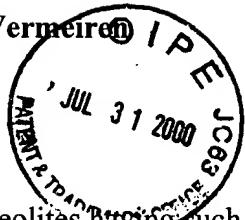
If the Examiner considers that Claim 1, in addition to Claim 20, is obvious over EP 0109060 in view of Cosyns, it is submitted that, while Cosyns does disclose a diene hydrogenation process, there would have been no motivation to the skilled person, absent hindsight knowledge of the present invention, to incorporate Cosyns' diene hydrogenation process into the process disclosed in EP 0109060. EP 0109060 merely discloses that the feedstock comprises “olefin cuts C4- to C12-“ (page 1, line 21) which are characterized as “more or less heavy olefinic cuts” (page 3, lines 18 to 19). There is no suggestion that the feedstock should not contain dienes or that, if they do, there would be any technical problem in the subsequent oligmerization process. Accordingly, the

person skilled in the art would not look to Cosyns to solve any technical problem in EP 0109060. Cosyns is merely concerned with the hydrogenation of olefins contained in a steam cracking volatile stream and in Example 1, it is merely disclosed that the olefins comprise only 4% by weight of the feedstock stream. This appears to be a totally different feedstock from that required by EP 0109060. Accordingly, it is submitted that the skilled person, even aware of Cosyns, would not consider importing the hydrogenation process or feedstock of Cosyns into the polymerization process of EP 0109060 having an olefinic feedstock.

Claim 24 was rejected under 35 USC §103(a) as being obvious over EP 0109060 in view of Cosyns and Gajda or, alternatively, over EP 0109060 in view of Cosyns and Kuehl. Specifically, the Office Action suggests that EP 0109060 and Cosyns disclose processes as noted above. Gajda discloses a de-aluminating process of cracking a catalyst by steaming the catalyst and then contacting the steamed catalyst with an aqueous solution. Kuehl discloses de-alumination of zeolites used in catalytic cracking to silica/alumina molar ratios of 30,000 or greater.

Although Gajda discloses the use of steaming and de-alumination of zeolite-beta, it is merely disclosed that “the steaming process will remove aluminum such that the framework ratio of $\text{SiO}_2/\text{Al}_2\text{O}_3$ would be increased to a range of about 30 to 200” (column 3, lines 18 to 19). This ratio corresponds to a silicon/aluminium atomic ratio of from about 15 to about 100, significantly less than the range required by amended Claim 1, upon which Claim 4 is dependent. Accordingly, even though Gajda discloses a de-alumination process, there is no suggestion of the combination of a de-alumination process producing the specific silicon/aluminium atomic ratio of from 180 to 1000 required by Claim 24, which is dependent on Claim 1.

Kuehl does not disclose de-alumination of zeolites to result in zeolites that can have silica/alumina molar ratios of 30,000 or greater. Kuehl merely discloses, at Column 4, lines 20 to 22, that in “some zeolites, the upper limit of silica to alumina molar ratio is unbounded with values of 30,000 and greater.” This does not constitute a teaching that



Kuehl's de-alumination process results in zeolites having such molar ratios. In any event, such a range of molar ratios is wholly different from the range required by Claim 1 of 180 to 1000 for the silicon/alumina atomic ratio, Claim 24 being dependent on Claim 1.

Kuehl does not suggest de-alumination of the catalyst to achieve the silicon/aluminum atomic ratio of from 180 to 1000, but rather discloses the achievement of much lower silicon/aluminum atomic ratios.

Claim 12 has been amended for proper dependency. A Petition and Fee for Extension of Time, under 37 CFR §1.136(a) is being submitted concurrently with this Response. The Commissioner is hereby authorized to charge any fees due by filing this paper or to credit any overpayment to Account Number 03-3345.

On the basis of the above amendments and remarks, reconsideration of this application is requested and its allowance requested at the Examiner's earliest convenience. No new matter has been added.

Respectfully submitted,

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